ORIGINAL ARTICLE

Healthy Hands: Development and Evaluation of a Knowledge Transfer Program

Nurul Azmawati Mohamed[1], Tengku Zetty Maztura Tengku Jamaluddin[2], Zarini Ismail[1], Mohd Dzulkhairi Mohd Rani[1], Shalinawati Ramli[1], Habibah Faroque[1], Farishah Nur Abd Samad[1], Abdul Rasyid Ariffien[1], Aisyah Ar Redha Che Amir Farid[1], Ilina Isahak[1]

[1] Faculty of Medicine & Health Sciences, Universiti Sains Islam Malaysia, Menara B, Persiaran MPAJ, Jalan Pandan Utama, Pandan Indah, 55100 Kuala Lumpur, Malaysia
[2] Faculty of Medicine & Health Sciences, Universiti Putra Malaysia, 43400 Serdang, Selangor, Malaysia

ABSTRACT

Introduction: Children in pre-schools are at high risk of getting infections due to overcrowding, minimal awareness of basic hygiene and lack of immunity against microorganisms. Hand hygiene practice should be started at home where parents set good example, followed by formal education in pre- schools, primary and secondary school. This study aimed to develop a comprehensive program on hand hygiene practice in pre-schools. This paper presents the developmental aspects of the program material and the results of its evaluation process in a selected pre-school. **Methods:** Stage of development involved preparation of song, lyric, video clip, infographic and tablet application. The module was introduced during an intervention day called 'Healthy Hands' day. The acceptance of the module was evaluated before and after the intervention day. Evaluation was done by assessing pre-school children by face-to-face interview about knowledge on hand hygiene techniques and routine, such as before or after certain activities. **Results:** We managed to compose a song in three languages (Malay, English & Arabic), produced a video clip, an infographic and tablet application. A total of 227 children participated. Post intervention evaluation showed significant ($p<0.001$) increase of knowledge for eight out of eleven handwashing steps. The knowledge on hand hygiene routine i.e. after toilet, after playing outdoor, after sneezing and after playing with pet was also increased significantly. **Conclusion:** This comprehensive knowledge transfer program significantly improved the children's hand hygiene techniques and routine and is recommended to be integrated into pre-school curriculum.

Keywords: Pre-school children, Hand hygiene, Infographic, Knowledge transfer program

Corresponding Author:
Nurul Azmawati Mohamed, MPath
Email: drnurul@usim.edu.my
Tel: +603-42892400 etx 1106

INTRODUCTION

Children in pre-schools are at high risk of getting infections due to overcrowding, minimal awareness of basic hygiene and lack of immunity against microorganisms (1). About 50% of child death are due to diarrhea and acute respiratory infections (2). The most effective and easiest practice to prevent transmission of infectious diseases is by complying to proper hand hygiene in daily activities (3,4).

Hand hygiene practice should be started at the early age at home where parents set good example, followed by formal education in pre- schools, primary and secondary schools (5). An earlier study by Mohamed et al. (2018) had shown that knowledge of pre-school children increased after being exposed to multiple hand hygiene related interventions that include interactive games, story-telling, posters and hands on training (6). In previous study, it was indicated that hand hygiene compliance were strongly influenced by the knowledge and awareness on the hand hygiene guidelines, habit and perceived behavioral control (7).

Our study aimed to develop a comprehensive program on hand hygiene practice for pre-school children. This paper presents the developmental aspects of the program material and the results of its evaluation process in a selected pre-school. This study is a part of a larger study on hand hygiene among pre-school children. The outcome of the evaluation study will help us to recommend the program and module to be integrated into pre -school curriculum.

MATERIALS AND METHODS

Duration and Place of Study

This study was done in 12 months, from July 2017 until July 2018. During the development stage, all discussion and computer work were done in the Faculty of Medicine & Health Sciences, Universiti Sains Islam Malaysia. The trial and evaluation stages were done in Tadika Sulaimaniyyah, in Putrajaya.

Stage of Development

Series of discussion with a research group that comprised of clinical microbiologists, an infection control specialist and a public health physician were conducted to establish a comprehensive program. Literature review was initiated to study past projects and findings. Extensive online searches were done to explore available materials. The content of the program materials was developed based on World Health Organization (WHO) recommendations on hand hygiene. The group decided to include project name, logo, song, video clip, tablet application and infographic in this program. An electronic monitoring system of proper hand washing technique was developed by Mundipharma Pharmaceutical Sdn. Bhd. The next steps involved getting feedback from all group members in term of practicality and suitability of the materials.

Stage of Trial

'Healthy Hands' program inclusive of a one-hour session, and 8-weeks of monitoring was introduced in Tadika Sulaimaniyyah, that involved 277 children aged five to six years old. The training session showcased the newly developed materials inclusive of video clip, infographic, song, as well as hands-on hand hygiene practice with Glo Germ. Hand hygiene posters and 22 android-based tablets with the monitoring system of hand washing technique were placed at all the student's sinks. The tablet application able to monitor children's hand hygiene performance through detection of movement. Reward in form of "star' was given after each correct hand washing step. Monitoring was done simultaneously in 11 classes (with 277 children) for 8 weeks.

Stage of Evaluation

The evaluations were done before and after the program. The sample size was calculated by using an online sample size calculator (OpenEpi). We used 52% for prevalence of children with adequate knowledge on hand hygiene (8), with the confidence interval of 99% and the power of study 95%. The calculated sample size needed for this study was 212. In pre-intervention phase, face-to-face interview using validated questionnaire was done. The questionnaire consisted of two main components, hand washing technique and hand washing moments. After eight weeks, another face-to-face interview was done using similar questionnaire. Collected data was analysed using IBM Statistical Package for the Social Science (SPSS) software version 20.0.

RESULTS

Program Materials

We decided to do an hour program called 'Healthy Hands' that involved presentation of infographic, video clip and hands on practical, followed by an eight week installation of tablet with hand hygiene applications at the pre-schools hand washing facilities.

1.Project Name & Logo

'Healthy Hands' phrase was chosen because it was concise, catchy and have straight-forward connotation. The logo comprised of the illustration of six small palms, arranged in a circle. The palms illustration were surrounded by bubbles that represent soap foams. 'Healthy Hands' phrase was located under the palms and bubbles images. All three elements represent healthy and clean hands that indirectly prevent children from getting infections.

2.Song and Lyrics

Series of meet up were held to compose the song. The song combined two popular nursery rhymes in Malaysia (Mulberry bush & 'Bangun pagi') and the lyrics were prepared in three languages: Malay, English and Arabic. The lyrics contained messages on hand hygiene steps and its importance. The song was recorded in a studio, and sang by three children aged five to 12 years old. To make it more interesting, an interactive and child-friendly audiovisual (video clip) was also developed. The video was established by using a free video application, available online. All images and cartoons were drawn by an amateur illustrator.

3.Infographic

This video emphasized on the importance of hand hygiene and when to practice hand hygiene. It was established by using cloud-based online software, PowToon. All images and cartoons were either taken from internet (no copyright) or drawn by an amateur illustrator. The narration was simple, easy to understand and uses a child's voice.

4.Tablet application

This application aimed to guide children to perform proper hand washing technique. The application automatically switched when someone washed their hands at the sink. The application displayed a two-dimensional animation of hand washing steps (Fig. 1) while simultaneously detecting movements for monitoring. Reward in form of "star' was given after each correct hand washing step.

Evaluation

A total of 277 children participated in this study. As shown in Table I, the children showed significant improvement for all recommended crucial hand washing

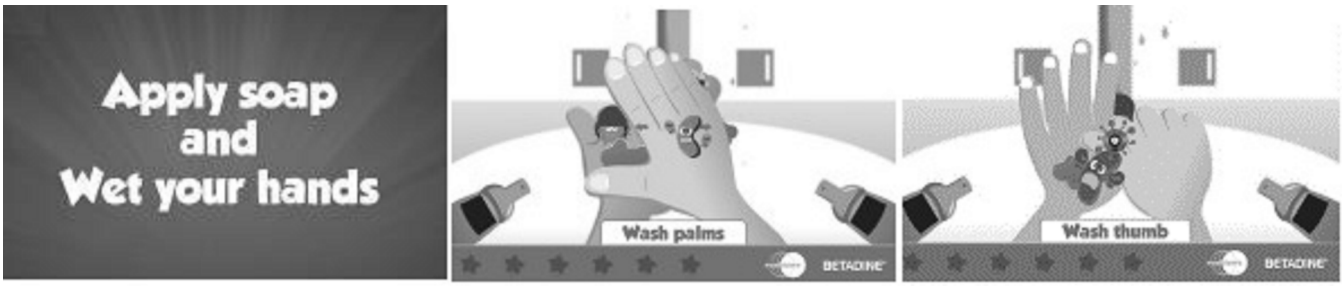

Figure 1: Tablet application with animated engagement and hand movement sensory

Table I: Distribution of sample according to current hand hygiene routine

Recommended hand washing time	Performed pre-intervention Frequency (%)	Performed post-intervention Frequency (%)	*p* value
After toilet	173 (76.2)	200 (88.1)	p<0.001
Before and after meals	206 (90.7)	215 (94.7)	0.150
After playing outdoor	121 (53.5)	187 (82.4)	p<0.001
After sneezing	102 (44.9)	184 (81.1)	p<0.001
After playing with pets	127 (55.9)	182 (80.2)	p<0.001

times. There were statistically significant differences in the number of children performing hand wash on 4 out of 5 crucial times, namely after toilet, after playing outdoor, after sneezing and after playing with pets. No significant difference was seen before and after meals between pre- and post-program implementation as the children showed high initial percentage (90.7%) at baseline. Results indicated that high percentages of children (95.2%) wet their hands under running water at the start of a hand wash. A statistically significant improvement for all subsequent steps was seen in the post-intervention phase as shown in Table II. Generally, the children showed improvement for almost all of the hand washing steps.

Table II: Distribution of sample according to observed hand washing technique.

Step		Performed pre-intervention Frequency (%)	Performed post-intervention Frequency (%)	*p* value
1	Wet hands under running water	216 (95.2)	216 (95.2)	1.000
2	Use soap on the hands	141 (62.1)	170 (74.9)	0.007*
3	Rub hands palm to palm	200 (88.1)	218 (96.0)	0.002*
4	Rub hands palm to palm with fingers interlaced	126 (55.5)	163 (71.8)	p<0.001
5	Rub right palm over back of left hand, and vice versa	81 (35.7)	147 (64.8)	p<0.001
6	Clean the back of fingers to opposing palms with fingers interlocked	21 (9.3)	54 (23.8)	p<0.001
7	Rotational rubbing of the thumbs	13 (5.7)	104 (45.8)	p<0.001
8	Rotational rubbing of the fingertips on palm	11 (4.8)	76 (33.5)	p<0.001
9	Rotational rubbing of both wrists	17 (7.5)	70 (30.8)	p<0.001
10	Rinse hands with water	110 (48.5)	170 (74.9)	p<0.001
11	Dry hands	101 (44.5)	176 (77.5)	p<0.001

DISCUSSION

According to Curtis et al. (2009), hand hygiene promotion programs that move away from the simplistic assumption that imparting knowledge about germs and disease will change behaviour are needed (9). Instead of imparting knowledge about the danger of infection and its complication, the program shall focus more on the correct technique of hand hygiene and the correct time to do hand hygiene. In 2007, the Ministry of Health Malaysia produced a guideline entitled 'Garis Panduan Pengendalian Kanak-Kanak di Taska dan Pra Sekolah' with the aim to provide safe and hygienic environment for children's growth and development. This guideline elaborates on basic hygiene for children and their environment and also emphasizes on prevention of infectious diseases. In line with the guideline, materials developed in this study would be a valuable tool to impart the hand hygiene knowledge to pre-school children.

Structured hand hygiene practice had been practiced widely in European pre-schools, junior and senior school level. However, none was found teaches proper steps of hand hygiene (10). Similar situations are also observed locally. Basic hygiene including hand hygiene is taught at all level, either in science or physical & health education subject. A survey showed that most pre-school children only knew and practiced these steps: 1) Using water 2) Using soap 3) Wash palm to palm 4) Rinse with water and 5) Dry both hands with towel (6). We introduced multiple intervention strategies that include song, infographic, hands-on and tablet application to suit children's need. Various mode of message delivery is important to increase the knowledge, attitude and practice of hand hygiene techniques (6).

Evaluation study showed that the knowledge improved significantly in hand hygiene techniques. Knowledge of hand hygiene steps as outlined by WHO were significantly increased except for the first step of wetting their hands under running tap water which showed no increment describing that all of them do wet their hands in the beginning of their basic hand washing practice. In addition to that, the knowledge of hand hygiene routines such as washing hands after toilet, after playing outdoor, after sneezing and after playing with pets were significantly increased compared to the pre-intervention

phase. This finding is supported by a similar study where it was proven that hand hygiene compliances increases after having adequate knowledge and awareness on the importance of hand hygiene (7). However, knowledge on hand hygiene before and after meal was already high in pre-intervention phase, thus the increment was not significant. This showed that these children understood and aware on the basic routines as being taught during the 'Healthy Hands' day and they must have read the hand hygiene posters hanged near the sinks.

CONCLUSION

This comprehensive knowledge transfer program on hand hygiene for pre-school children was well accepted by the children, proven by the significant improvement in their hand hygiene techniques and routine. Looking forward, future projects would have to include parents' and teachers' involvement to ensure sustainability of the knowledge and compliances. The outcome of this study will help us to recommend the program and module to be integrated into pre -school curriculum.

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